ELECTRO RENTS

B & K INSTRUMENTS, INC.

5111 WEST 164TH ST. • CLEVELAND, OHIO 44142

Bruel & Kjaer
Precision
Instruments

B & K INSTRUMENTS, INC.

CHO LAB

INSTRUCTION MANUAL
FOR
MODEL 166B/S.45
ENVIROMENTAL NOISE CLASSIFIER

11043

Damage to 4117 Microphones

The diaphragm of the B & K Model 4117 microphone used on this instrument is delicate. Do not touch. The diaphragm should have a smooth, conical shape. Microphone diaphragms which show slight radial creases have been damaged by either improper handling or calibration, and must be replaced. Replacement microphones are priced $110. each, FOB Cleveland.

Acoustical calibration must be made with the B & K Model 4230 Calibrator. Other calibrators, which may have little or no pressure relief, can subject the diaphragm to excessive positive or negative pressures when the calibrator is attached or removed. This excessive pressure will damage the microphone.

April 1974

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ILLUSTRATIONS

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DRAWINGS

D.1679,	Issue 4	Schematic Diagram
C.1725,	Issue 1	Component Layout XC.1-0166 (Analog Board)
B.1726,	Issue 3	Component Layout BL.2-0166 (Power Supply)
C.1727,	Issue 1	Component Layout BL.3-0166 (Digital Board)
A.1812,	Issue 1	Schematic, BL.6-0166 (Crystal Oscillator Bd.)
A.1669,	Issue 1	Component Layout BL.6-0166 (Crystal Osc. Bd.)

NOTE

TO USERS OF THE MODEL 166B/S.45 ENVIRONMENTAL NOISE CLASSIFIER

For greater dynamic range, two Model 166 units can be used in parallel, with one microphone.

In setting up for this arrangement, be sure that

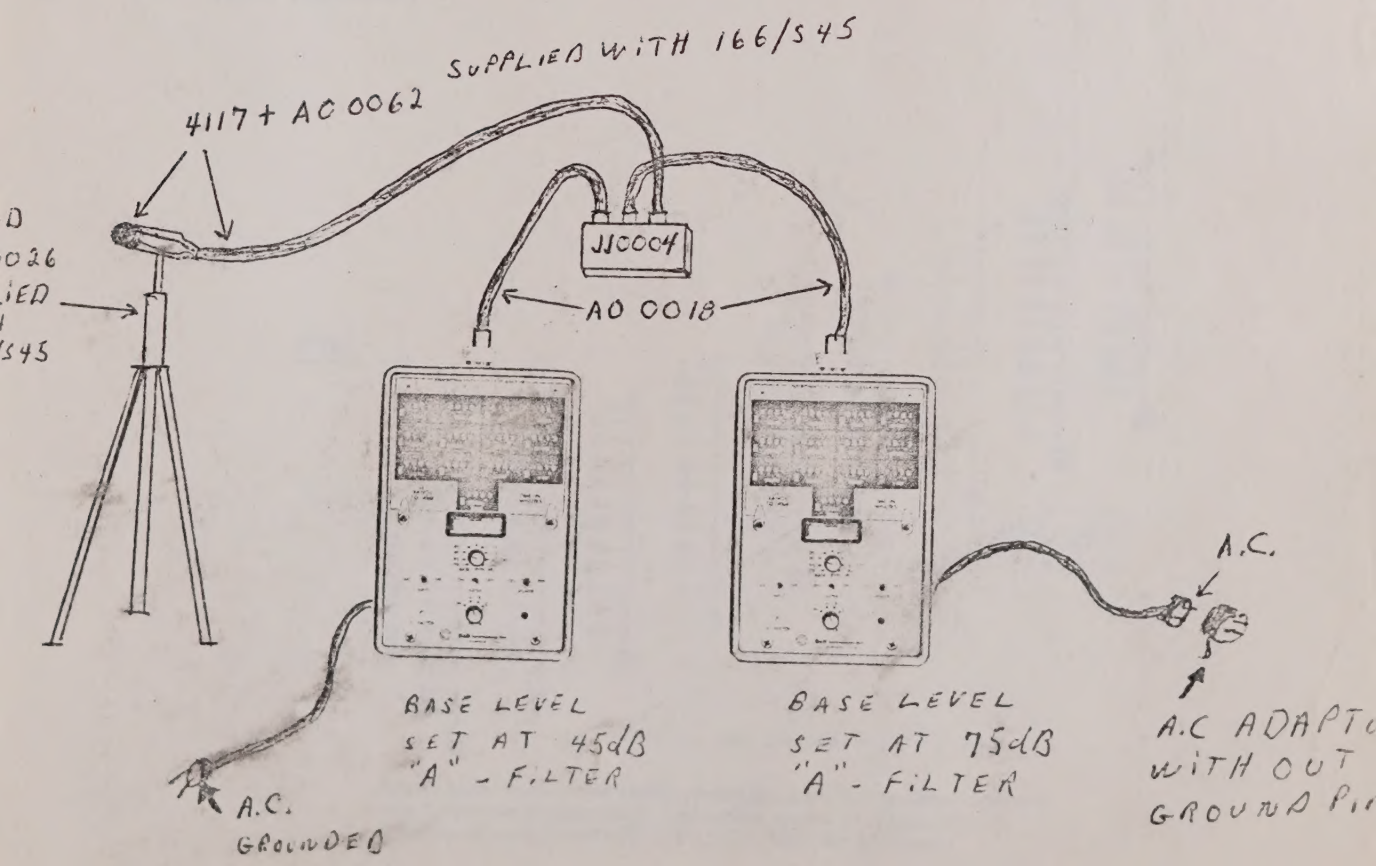
(a) the unit set at the lowest base setting has a good electrical chassis ground;

(b) the unit set at a higher base level is not connected to any electrical ground.

This will prevent any possibility of ground loops.

The following accessories are needed for parrallel operation of two Model 166B/S.45 units:

One Model JJ 0004 Junction Box
Two Model AO-0018 Coaxial Cables.



SECTION I

1.1 INTRODUCTION

The noise levels in urban areas and large plants are often irregular, changing from day to day or from hour to hour, depending on traffic flow, weather, day of week, etc. The analysis of such random noise patterns cannot be made in exact terms but must be assessed statistically. As an example, L_{10}, L_{50}, L_{90} values refer to the 10%, 50% and 90% exceedance levels and are commonly used in reporting urban noise analyses.

1.2 DESCRIPTION

The B & K Model 166 Environmental Noise Classifier is a self-contained instrument which can be used to obtain the statistical distribution of noise. The Model 166 divides the noise level into eleven amplitude classes and one exceedance class. The base line of the analysis can be set from 60 to 100 dB or dB(A) in nine 5 dB steps. The operating ranges are shown in Figure 1, below. The total time of the test is also recorded.

FIG. 1

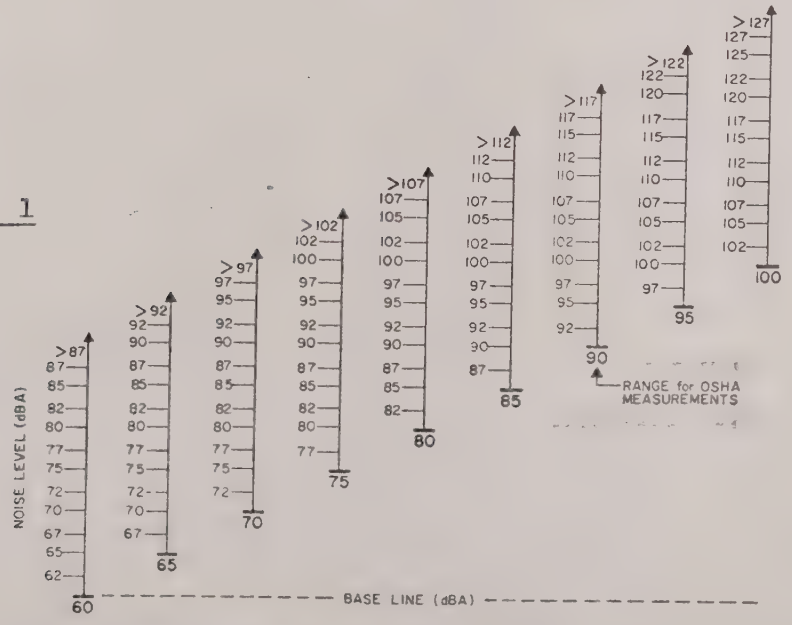


Fig. 1. Each range of the 166 Environmental Noise Classifier is divided into 11 classes of alternate 2- and 3-dBA widths as shown. The 12th classification indicates levels higher than the 11th band.

SECTION II
(166B)

2.1 SPECIFICATIONS

Operating Temperature:	0^{o} to 50^{o} C.
Microphone:	B & K Model 4117 One-Inch Ceramic Microphone
Input Impedance:	2 Megohm
Input Sensitivity (Input level required to start lowest level counter) :	MIC(rophone) Position: 60 Microvolt DIR(ect) Position: 1 mV
"K" Factor Range:	± 3 dB
Frequency Response Linear:	20 Hz to 20 kHz ± .5 dB
A-Weighted:	± .3 dB of Linear at 1000 Hz.
B-Weighted:	" " " " " "
C-Weighted:	" " " " " "
Signal Rectifier:	Quasi RMS (3 : 1 Crest Factor)
Time Constant:	Slow
Resolution (see Options) Sampling Time:	.01 minute (.6 sec.)
Counter Display:	.1 minute (60 sec.)
Total Time:	0 to 999.9 minutes (16.6 hrs.)
Class Accuracy:	± .5 dB
External Outputs (see Options) :	12 outputs for 12 bands, solid-state switch capable of 30 mA - 25 V. Timing Output Pulse (6 sec.period) AC Output 100 mV to 5 V nominal (short circuit protected); 10 K load
Acoustical Performance: (Sound Level Meter Type 2/S)	Meets specifications of ANSI S1.4-1971; "S" refers to readout in time accumulation of amplitude levels on counters.
Power Consumption:	AC mains 115V ± 10%; 60 cycles; 6 watts External 12V Battery (not included, available as Option); 4.5 Amp/hrs: (8 hours continuous operation).
Dimensions:	7" x 7" x 9"
Weight:	10 lbs.

SECTION II - Continued

2.2 ACCESSORIES (not included as standard complement with Model 166 Environmental Noise Classifier)

2.2.1 Acoustic Calibrator (B & K Model 4230)

For calibration of the Model 4117 Microphone on the Model 166 Classifier, a sound level of 94 dB at 1000 Hz is recommended. The Model 4230 Acoustic Calibrator has a calibration frequency of 1000 Hz ±1.5%, a sound pressure level of 94 dB re $2 \times 10^{-5} Nm^2$, and self-contained battery.

2.2.2 Microphone Extension Cable

For remote operation of Microphone, the following extension cables are available:

Model AO-0062 - 10 ft. extension cable

Model AO-166/30 - 30 ft. extension cable.

2.2.3 OSHA Noise Report Forms

Order in pads of 100 sheets as Model 1-166.

2.2.4 Windscreen for Microphone on Model 166 - Model UA-0207

Order as Model UA - 0253 1-inch polyurethane windscreen (package of 6).

2.2.5 Battery Pack (ZG 166)

Leather Carrying Case containing 12 V battery, 8 Amp/hr. capacity, and charger. Continuous operation greater than 16 hours.

2.2 ACCESSORIES (Cont'd)

2.2.6 Condenser Microphone Option

The Model 166 Classifier can be used to measure noise levels with Type 1 Sound Level Meter accuracy when used with a 1-inch Condenser Microphone. By placing the Classifier in the "DIR(ect)" input mode, the input is referenced to 50 mV per N/m^2. Use of the 1-inch Condenser Microphone requires an external condenser microphone power supply. The available microphones, microphone preamplifiers and power supplies are listed below:

Microphones: Model 4144 - 1-inch, condenser microphone, pressure; 3 Hz - 7 kHz.

Model 4145 - 1-inch, condenser microphone, free-field; 3 kHz - 18 kHz.

Microphone Preamplifiers: Model 2619- with 6.5 ft.cable, ≤0.03 dB attenuation; use with
Model DB-0375 Adapter, 1-inch, for 2619 Preamplifier.

Microphone Power Supplies:

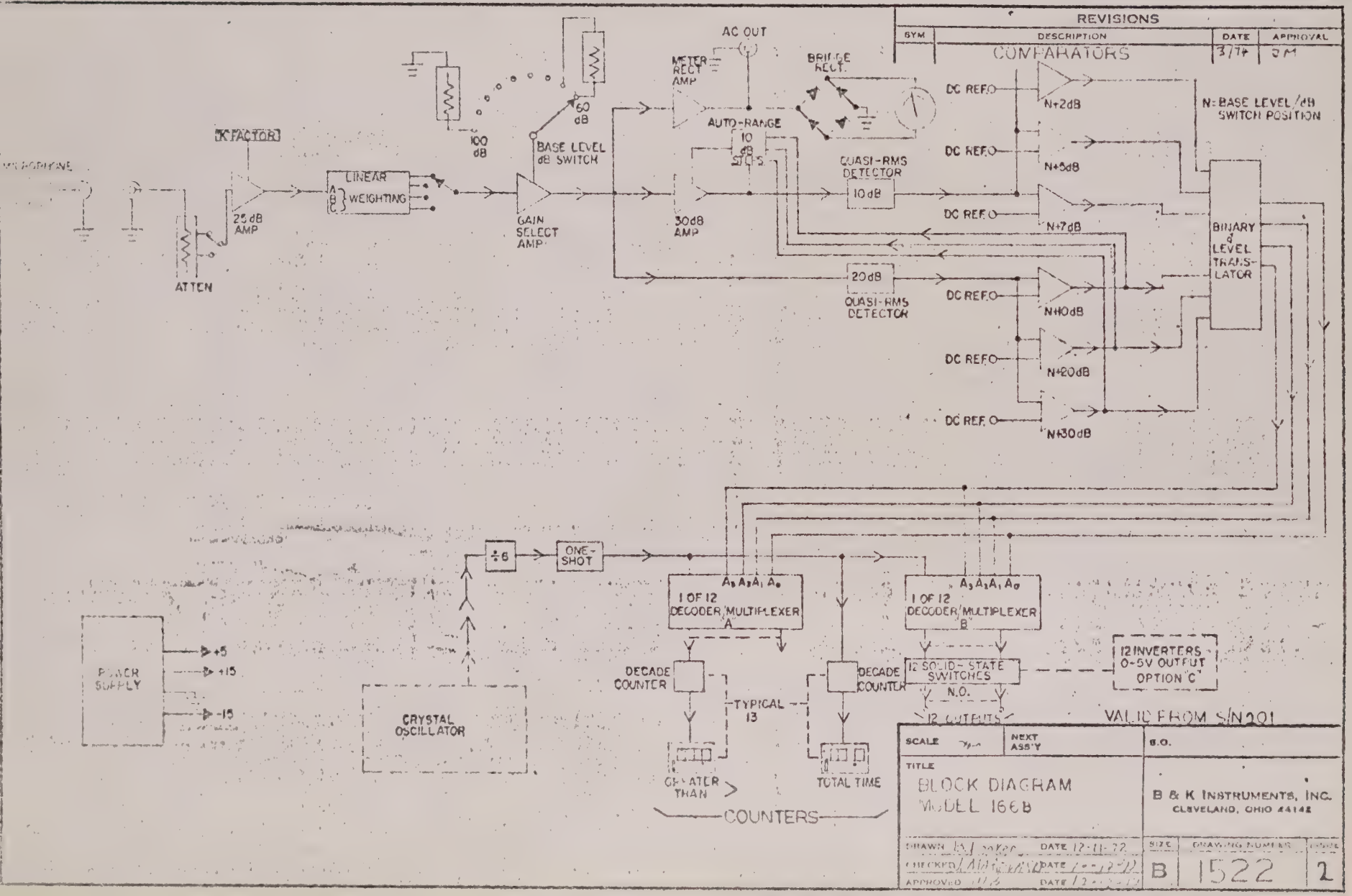
Model 2801 - AC operated, single channel;
Model 2803 - AC operated, dual channel;
Model 2804 - Battery-operated, dual channel.

Coaxial Cable between microphone power supply and Model 166 unit:

Model AO-0014 - 1.2 meters
Model AO-0019 - 3.0 meters
Model AO-0026 - 10.0 meters.

Microphone Adaptors:

The Model 4117 Ceramic Microphone is supplied with the standard Model 166 Classifier. This microphone has free-field response and is used to point directly at the noise source (0^o incidence). For measurement of ambient noise, a Random Incidence Corrector, Model UA-0055 is available to replace the standard grid on the 4117 microphone.


REVISIONS
SYM
DESCRIPTION
DATE
APPROVAL
COMPARATORS
3/74
JM
AC OUT
METER RECT AMP
BRIDGE RECT.
AUTO-RANGE
10 dB STEPS
DC REF.O
N+2dB
N+5dB
N+7dB
N+10dB
N+20dB
N+30dB
N: BASE LEVEL/dB SWITCH POSITION
BINARY LEVEL TRANSLATOR
QUASI-RMS DETECTOR
10dB
20dB
30dB AMP
GAIN SELECT AMP
BASE LEVEL dB SWITCH
60 dB
100 dB
K FACTOR
25dB AMP
LINEAR
A
B
C
WEIGHTING
ATTEN
÷6
ONE-SHOT
1 OF 12 DECODER MULTIPLEXER A
1 OF 12 DECODER MULTIPLEXER B
DECADE COUNTER
TYPICAL 13
GREATER THAN
TOTAL TIME
12 SOLID-STATE SWITCHES N.O.
12 OUTPUTS
12 INVERTERS 0-5V OUTPUT OPTION 'C'
POWER SUPPLY
+5
+15
-15
CRYSTAL OSCILLATOR
COUNTERS
VALID FROM S/N 201
SCALE
NEXT ASS'Y
B.O.
TITLE
BLOCK DIAGRAM
MODEL 166B
B & K INSTRUMENTS, INC.
CLEVELAND, OHIO 44142
DRAWN
DATE 12-11-72
CHECKED
DATE
APPROVED
DATE
SIZE
B
DRAWING NUMBER
1522
REV
2

SECTION III

PRINCIPLES OF OPERATION

Figure 2 shows the block diagram of the Model 166 Environmental Noise Classifier. With Model 4117 Ceramic Microphone, supplies as standard component of the Model 166, the instrument meets ANSI Type 2-Special specifications. By using the AC output of other Bruel & Kjaer instruments of Type 1 quality, Type 1 analyses can be made.

3.1 Input Amplifier

The input signal is fed to the input amplifier which acts as an impedance converter and buffer amplifier with approximately 25 dB gain. The amplifier has a variable gain, approximately ±3 dB, to allow for calibration adjustment. The input impedance of the Model 166 is 2 Megohms.

3.2 Weighting

The output of the input amplifier goes to a weighting network and linear normalizing pad. The output of the weighting network is switch-selectable between the linear pad which normalizes the signal to the level of the weighting networks "A", "B" or "C". The typical response curves of the filter are shown in Figure 3. The linear response is 20 Hz to 20 kHz ± .5 dB.

3.3 Gain Select Amplifier

The output of the filter section is fed to a variable gain amplifier. Its gain is switch-selected through precision resistors in the feedback path. The amplifier has a maximum gain of 48 dB selectable in 5 dB steps, and a minimum gain of 8 dB. The residue of 8 dB gain stabilizes the operational amplifier in the minimum gain position.

From the gain select amplifier, the signal follows three different paths.

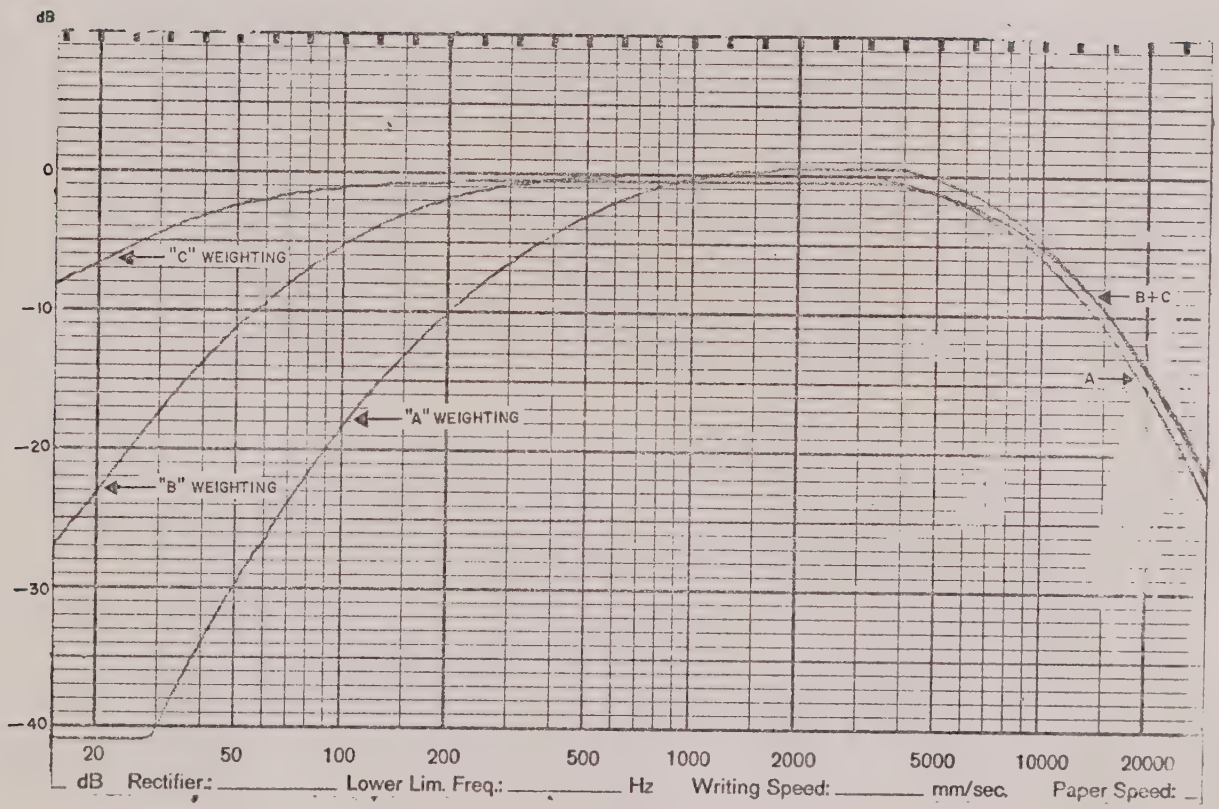


FIG. 3 Typical Response Curves of Filter

SECTION III - Continued -

3.4 AC Output and Meter Amplifier

The first path is to a unity gain amplifier for providing an AC output and driving a bridge rectifier and associated meter. The AC output can be shorted to ground without damage to the amplifier. While using the meter circuit for calibration, no less than 10 K-ohms should be used as the output load.

3.5 Quasi RMS Detector and Comparators

A second signal path from the gain selector amplifier is applied to a 20 dB quasi RMS detector. This detector feeds three comparators, each referenced 10 dB apart. Each comparator feeds a logic level translator circuit and an auto-ranging circuit in the last amplifier.

3.6 Auto-range Amplifier

The third signal path from the gain select amplifier goes to a final 30 dB amplifier and an auto-range circuit. This circuit consists of 3 FET transistors shunting three precision resistors in the feedback circuit of the amplifier. The FET's are used as switches and are operated by the three comparators sensing the 20 dB quasi RMS detector output. The comparators operate sequentially and switch a FET "On" or "Off". As a result, a resistor is switched "In" or "Out" of the feedback network of the amplifiers and will attenuate the gain of the amplifier by 10 dB. The amplifier operates from 30 dB to unity gain in 10 dB steps, depending upon the signal driving the previous 20 dB detector discussed in 3.5 above.

3.7 10 dB Quasi RMS Detector and RC Time Constant Control Circuit

The output of the final amplifier is fed to a quasi RMS detector. This detector feeds three comparators. Associated with the detector is a charge-discharge circuit. When the gain of the final amplifier changes, the RC time constant circuit of the 10 dB detector must also be charged or discharged, as the gain increases or decreases, respectively. The comparators switching the auto-ranging circuit simultaneously drive the charge-discharge circuit to insure proper timing and levels at the 10 dB quasi RMS detector.

SECTION III -Continued-

3.8 Time Constants

See B&K Technical Review, No. 2, 1972, pages 38 thru 43.

3.9 Comparators and Logic Translator

All six comparators sense against the same reference line, but detect signals at different levels. The three comparators following the 10 dB detector sense when the signals is N + 2 dB (N = Base Level selected by the gain select amplifier), N + 5 dB, and N + 7 dB. The three comparators following the 20 dB detector sense when the signal is N + 10 dB, N + 20 dB and N + 30 dB. The comparator outputs are converted into zero to 5 volt logic levels, TTL-compatible. The six logic levels are also converted to a four-line binary number.

3.10 Digital Circuit

The four-bit binary number is fed to two 1-of-12 decoders. Decoder A is strobed on and off every .6 seconds by a timing circuit consisting of a 60 Hz line frequency driven Schmitt trigger to a divide-by-36 circuit, then a one-shot which strobes the decoder. When a binary number is present on the input of decoder A, one of the twelve outputs goes to a low logic level (0) on decoder A. This level is on for approximately 20 microseconds, as determined by the one-shot multivibrator strobing the decoder. The binary number is now converted into a 20 microsecond pulse from decoder A. This pulse is then counted by a digital decade counter which, after ten such counts, triggers a mechanical counter. Decoder A has twelve decade counters, digital and mechanical, on each of its outputs representing the 11 amplitude bands and one exceedance band. Decoder B is not strobed. The outputs from decoder B go to 12 buffer/drivers equivalent to a solid-state switch capable of 30 mA at 25 volts to operate external peripherals. (See Option "C" under "OPTIONS")

The total-time mechanical counter is driven from a digital decade counter, which in turn is strobed by the one-shot multivibrator, as in decoder A.

SECTION IV

OPERATING INSTRUCTIONS

(166-B)

4.1 Control Descriptions

POWER	115 V Operation: Use cable with AC adapter. 12 V (Battery) Operation: Battery Input Cable Connector Pin C - positive (clear lead) Connector Pin D - negative (black lead) Toggle Switch; Power "ON" - left Power "OFF"- right
PANEL LIGHT	Comes on with power
BASE LEVEL/dB	Refers to first counter's (top row - left) detected level in dB Nine ranges covering from 60 to 100 dB in 5 dB steps
INPUT	MIC(rophone) Position refers to input to Model 4117 Microphone sensitivity (3 mV per Nm^2) DIR(ect) refers input to 50 mV per Nm^2
"K" FACTOR	Used for normalizing microphone in conjunction with meter and acoustic calibrator (Model 4230)
METER	"ON" applies meter to analog circuit for use in calibration. Zero on meter is equal to 94 dB when in the 65 dB base level range.
COUNTERS	Red knob is for resetting counters to zero.
FILTER	Selects: LINear Response "A" Weighting "B" Weighting "C" Weighting

4.2 Preparation for the Measurement.

The Model 166 Environmental Noise Classifier is designed to operate from 115 V, 60 Hz. The time base of the standard instrument is derived from the line frequency. Operation at other line frequencies will give incorrect total time recordings, however, the distribution will be correct. A crystal oscillator is available for use with other power supplies (see OPTIONS).

No special installation instructions are required, but the physical location of the Model 166 unit is important. When the instrument is being used as an area or work station dosimeter, the microphone should be placed approximately at ear level and pointed in the direction of the predominant noise source adjacent to the subject. Avoid installing the Model 166 near corners or walls where sound reflections may become a problem. Avoid mounting the Model 166 on vibrating surfaces. All microphones are more or less vibration-sensitive and incorrect data may result from vibration-induced signals. As a check, set the Model 166 6o 90 dB(A) and observe which counters are operating. Lift the Model 166 from the surface. If these counters no longer operate, the location is not satisfactory.

4.3 Overlays.

To install an overlay, select it according to the desired base level. Push the two white retaining arms toward the bottom of the case. Place the slotted hole of the overlay into the two pins on the front panel and slide down. Adjust the two retaining arms on the overlay.

To remove the overlay, BE SURE TO SLIDE THE OVERLAY UP before lifting it from the front panel.

4.4 Operating the Model 166

4.4.1 CONTROL SETTINGS

Counters:	Set (or reset) to 000.0
Input:	"MIC."
Filter:	"A"
Meter:	ON
Base Level	"65 CAL."
Overlay	#1671 (65)
Power:	OFF

Screw the microphone and gooseneck into the threaded hole on the top of the unit. NOTE: The counters are actuated every six (6) seconds, but the unit samples every .6 seconds and accumulates 10 samples before actuating the counter.

Turn power switch to "ON". Some counters may actuate. This is normal. All counters should be reset to 000.0 during the first six seconds of operation. At this time, the panel light and chassis light are on and the total timer is actuating every six seconds. The panel light will flicker upon actuation of any counter. This is normal and shows proper operation of the counters.

4.4.2 CALIBRATION

With the control settings as in section 4.4.1, place the Acoustic Calibrator (Model 4230)** on the Model 4117 Microphone. Reset the counters and actuate the calibrator. The meter on the Model 166 should deflect. Turn the "K" Factor (screwdriver) adjustment clockwise for increase or counterclockwise for decrease, until the meter reading corresponds to the calibration level of the Model 4230 Acoustic Calibrator. The calibration value is located

** The Model 166 is set up for calibration of a 1000 Hz, 94 dB signal, such as provided by the Model 4230 Acoustic Calibrator (see ACCESSORIES).

4.4.2 Calibration (cont'd)

in the top cover of the Model 4230 Calibrator. The unit is now calibrated.

4.4.3 COMPARATOR CALIBRATION CHECK.

With the Model 166 unit and the Acoustic Calibrator operating as described above (the 4230 operates for approximately 1 minute, then must be reactivated if additional calibration time is required), the ≥ 92 dB counter should be operating. To check the operation of the other counters, turn the Base Level switch to the next higher (5 dB) setting (70 dB). The 87 to 90 dB counter will now actuate every 6 seconds. Continue to increase the Base Level in 5 dB increments and observe that every alternate counter is actuated.

Turn Base Level selector switch back to 65 CAL position and adjust "K" Factor for a meter deflection between +1 and +2 dB. Turn Base Level selector up 5 dB (to 70 dB). The 90-92 dB counter should be actuating every 6 seconds. Proceed to increase the Base Level in 5 dB steps and observe that every alternate counter actuates.

This calibration check is made to insure that the comparator levels are actuating in their proper sequence and correct levels.

NOTE: Calibration with the Acoustic Calibrator (Model 4230) should be completed before operation of the Model 166 at the desired survey location. To validate the measurement, recheck the calibration after completion of the test. (Log all counters before calibration to avoid adding incorrect data.)

The Comparator Calibration Check need only be performed periodically. If the comparator levels are not actuating properly, refer to "MAINTENANCE".

4.4.4 O S H A NOISE SURVEY.

By setting the base line at 90 dB(A), the Model 166 Environmental Noise Classifier may be used to establish compliance with OSHA Noise Regulations. A chart supplied with the Model 166 quickly converts amplitude class data into percent of permissible exposure for any normal work shift (see FIG. 4, below).

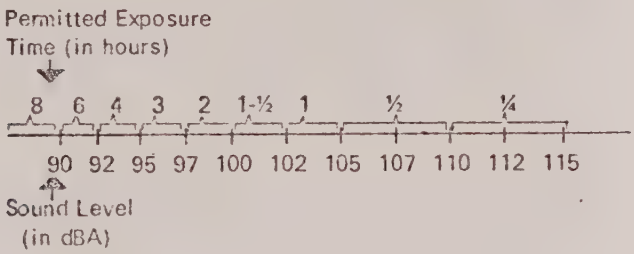


FIG. 4

To start the monitoring operation, select a location, as described in paragraph 4.2, and calibrate the instrument with a Model 4230 Acoustic Calibrator. After calibration set the BASE LEVEL to"90 dB" and place corresponding plastic OVERLAY (1676) on the front panel. Turn the FILTER knob to "A"; switch METER to "Off" and INPUT to "MIC." Reset all COUNTERS to "000.0" Turn POWER "ON". At this point, some counters may actuate. Be sure to reset these to 000.0 before the first 6-second period ends; then close and lock the lid. CAUTION: Do not jar the microphone by slamming the lid.

Operate the Model 166 for a full work shift, but no longer. The noise measured should represent the noise environment to which the employees are exposed. At completion of the monitoring period, log the time in minutes of the first 10 counters on the Noise Report Form (1-166). The total time and plant clock time should correlate for the elapsed time of operation, or the

4.4.4 OSHA Noise Survey (cont'd)

data obtained will not be valid for the survey. Any time accumulation in counters ≥115 dB indicates a violation of the OSHA Noise Regulation which states:

> "Employees must not be exposed to steady sound levels above 115 dB(A), regardless of duration."

The detailed test data recorded by the Model 166 Classifier, and evaluated in histogram form, provide guidance for corrective action for noise reduction and hearing conservation programs.

4.4.5 ANALYSIS OF TAPE RECORDED NOISE

This measurement requires a tape recorder of good quality, capable of linear measurement in the desired frequency band. Avoid domestic tape recorders with tone controls.

The tape recording should consist of a calibration tone obtained by using a Sound Level Calibrator on the microphone of the sound level meter feeding the recorder. The calibration tone should be applied before and after the recording to insure that the signal level is maintained. The output of the tape recorder may be plugged directly into the Model 166 Environmental Noise Classifier.

With the Input selector on "MIC.", the Base Level selector in the "65 CAL" position, adjust the output of the recorder, while the calibration tone is present, for a 94 dB deflection on the meter scale of the Model 166. The unit is thereby calibrated to the tape recorder output level, and may be set to any desired Base Level. Should the output controls of the tape recorder be too sensitive to adjust the Model 166 at the "65 dB CAL" position, switch the Model 166 Input from "MIC" to "DIRect". This will attenuate the input and allow

4.4.5 Analysis of Tape Recorded Noise (cont'd)

a broader range of input signal to be applied. If the Model 166 is calibrated in the "DIRect" position, the Base Level can be changed to any desired position for the signal to be analyzed, but the input must stay in "DIRect".

4.4.6 USING THE EXTERNAL OUTPUTS (Fig. 5)

On the side of the Model 166 Classifier a 15-pin connector is available. Pins 1 through 12 represent solid-state switches for the 12 amplitude bands, respectively. (Pin 1 - first detected band; Pin 2 - second detected band, etc.)** Each output is capable of switching a maximum of 30 mA at +25 V referenced to ground.

Pin 13 provides a timing pulse with a period of 6 seconds with a 5 volt logic level with a duty cycle of approximately 50%.

Pin 14 is an analog output of the selected weighting network, nominally 100 mV to 5 V RMS. The analog output, though protected against short-circuiting, should not be connected to ≤10 K load. If a ≤10 K load must be used, such as earphones, etc., it should only be applied after meter calibration.

Pin 15 is signal and digital ground.

One or more of the first twelve outputs can be wired to activate a tape recorder to record only the noise conditions exceeding predetermined limits. The outputs can also be used to trigger alarm bells or flashing lights for specified danger levels.

** An Output of 0 to 5 Volt Logic Level, TTL/DTL compatible, can be made available as Option "C".

A D D E N D U M

for

MODEL 166/S.45 (45 dB) MODIFIED UNITS

I. PRINCIPLES OF OPERATION

The Model 166/S.45 circuitry is identical to that described in Section III (pages 6-9) of this manual, except that an additional 15 dB gain is added in the feedback network of A2 by the base level selector. Also, the panel light and counters are put on a regulated supply for a lower noise floor,and more decoupling is applied to the analog circuitry.

II. CALIBRATING AND OPERATING INSTRUCTIONS

Step 1: Attach the AO-0062 Extension Cable supplied with the Model 166/S.45 to the top of the instrument.

Step 2: Detach the microphone from the gooseneck, using the Allen wrench supplied with the accessories. After loosening the Allen screw, slowly raise the microphone and unscrew the Microdot connector on the microphone. Then screw the microphone to the AO-0062 Extension Cable.

Step 3: Now calibrate the instrument according to the instructions given in paragraph 4.4.2 (page 12).

Follow the operating instructions given for standard Model 166 Environmental Noise Classifier units.

NOTE:

When using the instrument in the 45 dB base level position, be sure to set the FILTER SWITCH to the "A"-weighting position. Do NOT use the gooseneck for measurements or calibration in the 45 dB base level position. Because of the vibration sensitivity of the Model 4117 microphone, actuation of the mechanical counters when in the 45 dB position and using the gooseneck may cause erroneous readings. In all other base level positions, the gooseneck may be used.

The panel light flicker upon activation of the counters, as described in 4.4.1 (page 12) will not occur in the Model 166/S.45.

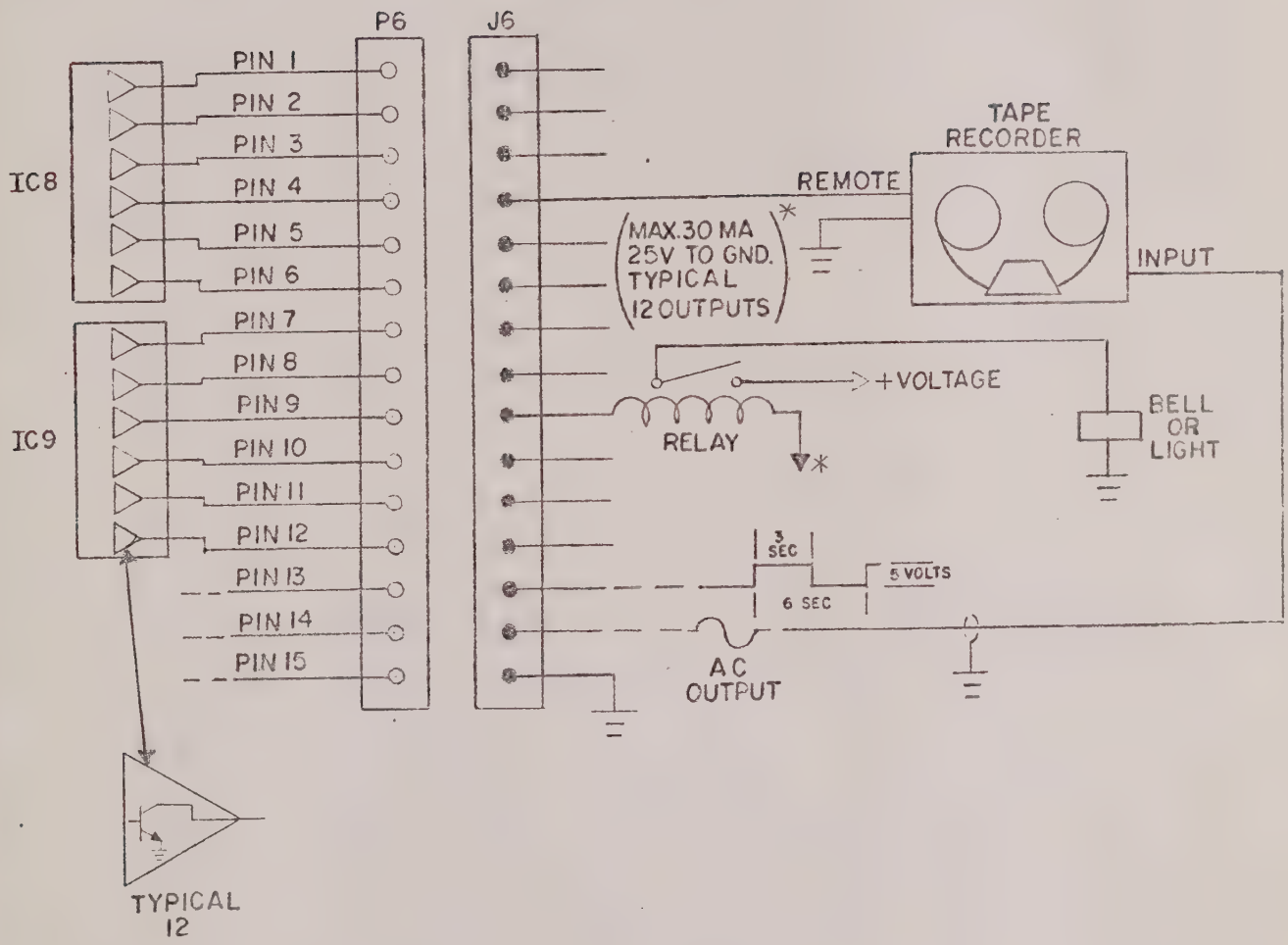


FIGURE 5 External Outputs of the Model 166

SECTION V

MAINTENANCE

The Model 166 Environmental Noise Classifier is factory-calibrated prior to shipment. The B & K calibration is performed using test equipment (oscillators, microphone amplifiers and oscilloscopes) capable of aligning the instrument to within ± .15 dB. If such equipment is not available at the user's facility, it is recommended that the instrument be returned, prepaid, to B & K Instruments for factory calibration.

At installations where proper test equipment and trained personnel are available, the following procedure is recommended:

5.1 Disassembly

5.1.1 Unplug the power cord.

5.1.2 Open the lid; then remove lid by applying pressure on the lid in the direction of the hinges and sliding lid upwards.

5.1.3 Remove the overlay on the front panel, as described in paragraph 4.3.

5.1.4 Remove the two 10/32 Phillips head screws located at the bottom of the front panel.

5.1.5 Remove the four 4/40 flat head screws on the front panel which are located around the counters.

5.1.6 Lift the front panel straight out of the unit and put it down in front of the instrument.

5.1.7 Microphone Removal - CAUTION!

To remove the microphone from the gooseneck, do not try to unscrew the microphone directly from the gooseneck. Locate the Allen screw which secures the microphone to the black microphone adapter and unscrew the Allen screw. Then lift the microphone and unscrew the Microdot connector from the microphone.

5.2 Setup Procedure

5.2.1 Set the controls of the Model 166 as follows:

Filter:	"A"
Input:	"MIC."
Base Level:	"65 CAL"
Meter:	"ON"

5.2 Setup Procedure (cont'd)

5.2.1 (cont'd)

Adjust the oscillator to be used (B & K Model 1022 or equivalent) for a 3 mV ± 1% 1 kHz signal into the input of the Model 166.

5.2.2 Set up a measuring amplifier (B & K Model 2603 or equivalent) to measure 3 volts full scale. Put the input lead from the measurement amplifier between ground and the orange test point located on the P.C. board mounted on the front panel of the Model 166.

5.2.3 Set up an oscilloscope with its vertical amplifiers to 1 volt per cm, operating in the DC mode, with its inputs between ground and the yellow test point on the P.C. board on the front panel of the Model 166 (XC.1-0166).

5.2.4 Apply power to the Model 166.

CAUTION: Do not touch the two wires running from the P.C. board to a terminal block located on the inside of the chassis. 117 V-AC present!

5.3 Meter Calibration

5.3.1 Adjust the "K" Factor for an output reading of 1.26 Volts ± 1% on the measuring amplifier.

5.3.2 Adjust potentiometer R.120 located on the P.C. board in the bottom of the chassis for a zero, 94 dB deflection on the Model 166 panel meter.

5.3.3 Turn the meter switch "Off" and increase the Base Level to "100 dB". Turn the oscillator output up to approximately 6 mV.

5.4 Comparator Calibration

5.4.1 Adjust the oscillator for a reading of 1.41 ± 1% on the measuring amplifier. At this voltage, the oscillator should show a positive deflection. Adjust potentiometer R. 60 located on P.C. board XC.1-0166 (see Component Layout) for the proper deflection. Increase the input oscillator voltage for an output increase of exactly 2 dB ± .1 dB. At this point, the oscilloscope should give a downward deflection to ≅ ground potential.

Adjust potentiometer R.62 for the proper deflection and increase the input for an output increase of 3 dB ±.1 dB. Now the oscilloscope should show a positive deflection. Adjust potentiometer R.64 for the proper deflection.

5.4 Comparator Calibration (cont'd)

5.4.2 Increase the input by 2 dB ± .1 dB; the output should attenuate 10 dB ± .3 dB, and the oscilloscope should show a negative deflection to ground. Adjust potentiometer R.66 for the proper attenuation point and deflection.

Increase the input 10 dB, and the output should attenuate 10 dB ± .3 dB. Adjust potentiometer R.68 for the proper attenuation point. Again increase the input 10 dB and the output should attenuate another 10 dB ± .3 dB. Adjust potentiometer R.69 for the proper attenuation point.

5.4.3 Repeat steps 5.4.1 and 5.4.2, increasing in 2 and 3 dB steps, starting with a 6 mV input. This should give positive deflection at first, then negative to ground, for a range of 27 dB. At each 3.16 V point on the output measuring amplifier, the signal will attenuate 10 dB.

At the user's option, the above setup procedure may also be used to set the amplitude bands for 2.5 dB steps, instead of 2 and 3 dB steps as required for OSHA measurements.

5.5 Offset Adjustment

5.5.1 With the unit set up as described above, increase the input to approximately 200 mV. Connect the oscilloscope between ground and the orange test point. Adjust the input until the signal on the oscilloscope starts clipping; then adjust potentiometer R.33 located on P.C. board XC.1-0166 for symmetrical clipping.

5.6 Weighting Normalization

5.6.1 Operate the Model 166 in the 100 dB Base Level position and set the Filter to "LIN", and the Input to "MIC". Now monitor a measurement amplifier which has been connected between ground and the orange test point on P.C. board XC.1-0166.

Apply 1000 Hz at approximately 11 mV for an output reading of 2.5 V. Switch from "LIN" to "A" Weighting; adjust potentiometer R.20 to within ± .3 dB of linear position. Then switch to "B" Weighting and adjust potentiometer R.15 to within ± .3 dB of linear position. Finally, switch to "C" Weighting and adjust potentiometer R.13 to within ± .3 dB of linear.

These instructions cover all variable adjustments for a field calibration. If the instrument should be found to perform below standard specifications and correction cannot be achieved with the above procedures, it is recommended that the unit be returned to B & K Instruments, Inc., 5111 West 164th Street, Cleveland, Ohio 44142, for factory calibration.

SECTION VI

AVAILABLE OPTIONS

6.1 ** OPTION "A" (BL.6-0166) -Factory installation only.-

- This option covers a Crystal Oscillator Board to be used in the Model 166 as an internal time base. Use of this option permits operation of the Classifier independent of line frequency variations. An inexpensive DC to AC inverter (frequency stability not important) could be used to power the Model 166. The Crystal Oscillator maintains the resolution of .6 seconds (standard) and total time of 16.6 hours on the Model 166.

6.2 OPTION "B" (BL.6-0166) -Factory installation only.-
This option provides a Crystal Oscillator Board, as described in 6.1, above, which allows the user to operate the Model 166 for a longer period of time (166.6 hours) and with a resolution of 6 seconds.

The counters, which read in tenth of a minute on a standard unit, will read in minutes with Option "B" installed.

6.3 OPTION "C" -Factory installation only.-
This option is to be used in conjunction with the External Output of the Model 166, as described in paragraph 4.4.6.
The standard outputs on the Model 166 (12 independent outputs for the amplitude bands) are representative of solid state switches. Option "C" changes the outputs to 12 digital outputs with 0 to 5V logic, TTL/DTL compatible.

** OPTION A included as standard component in Model 166B units.

ADDENDUM

to Model 166 Instruction Manual

CALIBRATION of Model 166 Noise Classifier using Model 2203 Sound Level Meter as the microphone input.

1. Connect proper cable between OUTPUT AMPLIFIER of 2203 to input socket of 166 after removing ceramic microphone and gooseneck.
2. Set INPUT of 166 to "Direct".
3. Set function selector of 2203 to "A", "B", "C", or "Lin." Either "Fast" or "Slow" response.
4. Set AMPLIFIER on 166 to "Lin" if A, B or C mode is selected on 2203. Otherwise set to desired weighting network.
5. Set BASE LEVEL on 166 to "90".
6. Set dB RANGE on 2203 to "90".
7. Set METER of 166 to "ON".
8. Apply a Model 4230 Acoustical Calibrator to the 2203 and set ADJ so meter deflects to a reading of"4 dB" on the upper meter scale. Calibration level of 94 dB SL is read as 90 dB on the attenuator plus 4 dB on the meter.
9. Adjust K-FACTOR on 166 so meter deflects to "94 dB".
10. Turn 166 METER to "OFF" and reset all counters.

OPERATION.

Set dB RANGE of the 2203 to a position where peak readings will not overdrive the meter. Do not reset BASE LEVEL of the 166.

The corrected base level of the 166 will be 25 dB below the dB RANGE setting on the 2203. At the calibration setting, the attenuator on the 2203 is set at 90 dB so the base level on the 166 is 65 dB. The scale bezel for 65 dB may be inserted. For low level measurements, there is no standard bezel. For example, if the 2203 attenuator is on 60 dB, the base level of the 166 is 35 dB SL. In this case, it is suggested that the 65 dB bezel be used and 30 dB subtracted from the indicated window graduations.

In the above procedure, the base level is not an even multiple of 10. To achieve an even-numbered base level, such as 30 dB below the 2203 attenuator setting, reset the 166 base level to 85 dB.

Corrected base levels below 25 dBA should not be used.

AJS:mer
4-2-74

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG. PART #
A1, 2, 4	Op. Amp.	Fairchild	FU5B7748393
A3, 5, 6, 7	Op. Amp.	Fairchild	FU5B7741393
A8, 9, 10	Op. Amp.	Fairchild	FU5B7741393
C1, 5, 14	Cap., Ceramic .47uF @ 50V	Erie	8131-050-651-474M
C2	Cap., Ceramic, 2.2pF @ 1kV	Erie	CK60BX2R2K
C3	Cap., Ceramic, 6.8pF @ 1kV	Erie	CK60BX6R8K
C4, 8, 9	Cap, Glass .02uF	Bruel & Kjaer	CG-0004
C6, 10	Cap., Mica, .005pF @ 50 V	Centralab	CK-502
C7, 18	Cap., Tantalum Elect. 4.7uF @ 35 V	I T T	TAG-20-4.7/35-20
C11, 12	Cap., Mica, 270 pF @ 300 V	C D E	CD10FC271J
C13	Cap., Mica, 510 pF @ 500 V	C D E	CD15FD511J
C15	Cap., Ceramic, 3.3 pF @ 1kV	Erie	CK60BX3R3K
C16	Cap., Tantalum Elect. 6.8 uF @ 25 V	I T T	TAG-20-6.8/25-20
C17	Cap., Ceramic, 8.2 pF @ 1kV	Erie	831-000-C0G0-829D
C19, 20, 21	Cap., Ceramic, .33 uF @ 50 V	Erie	8131-050-651-334M
C22, 23	Cap., Tantalum Elect. 1.5 uF @ 35 V	I T T	TAG-20-1.5/35-20
C24, 25, 26	Cap., Ceramic, .1 uF @ 50 V	Erie	8121-050-651-104M
C27, 28	Cap., Tantalum Elect. 15 uF @ 20 V	I T T	TAG-20-15-20-20
C52	Cap., Ceramic, 33 pF @ 1kV	Erie	801-000-C0G0-330J
D1, 4, 5, 6	Diode, Silicon	G.E.	IN 4148
D2, 3, 7, 11	Diode, Silicon	G.E.	IN 4148
D8, 13, 14	Diode, Silicon	G.E.	IN 4148
D15, 12, 16	Diode, Silicon	G.E.	IN 4148
D9	Diode, Silicon	G.E.	IN 4148
D17, 18, 19	Diode, Silicon	G.E.	IN 4148
D10	Diode, Zener, 5.1V	Motorola	IN 5231B
J1	Connector		
P2	Connector		
Q1	Transistor, Silicon	RCA	40407
Q2, 3, 4	Transistor, N-ch FET	Motorola	2N5459
Q5, 6	Transistor, N-ch FET	Motorola	2N5459

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG. PART #
R1	Res. Film, 1.87M, 1/4w, 1%	Dale	
R2	Res. Film, 115K, 1/8w; 1%	Dale	
R3,31,39	Res. Film, 10K, 1/8w; 1%	Dale	
R4	Res. Film, 133K, 1/8w; 1%	Dale	
R5	Res., Var., 150K, w. mounting hardware	Bourns	3852-E-162-154A
R6	Res., Film, 47.5K, 1/8w; 1%	Dale	
R7, 35	Res., Film, 68.1K, 1/8w; 1%	Dale	
R8	Res., Film, 453Ω, 1/8w; 1%	Dale	
R9	Res., Film, 2.26K, 1/8w; 1%	Dale	
R10	Res., Film, 18.7K, 1/8w; 1%	Dale	
R11	Res., Film, 12.7K, 1/8w; 1%	Dale	
R12,45,46	Res., Film, 4.99K, 1/8w; 1%	Dale	
R13,15,33	Res., Var., 100K	Bourns	3006P-1-104
R14	Res., Film, 249K, 1/8w; 1%	Dale	
R16, 18	Res., Film, 63.4K, 1/8w; 1%	Dale	
R17	Res., Film, 59K, 1/8w; 1%	Dale	
R19,79,	Res., Film, 499K, 1/8w; 1%	Dale	
R20	Res., Var., 50K	Bourns	3006P-1-503
R21	Res., Film, 357 Ω, 1/8w; 1%	Dale	
R22	Res., Film,95.3 Ω 1/8w; 1%	Dale	
R23	Res., Film, 357Ω 1/8w; 1%	Dale	
R24	Res., Film, 634Ω 1/8w; 1%	Dale	
R25	Res., Film, 1.13K, 1/8w; 1%	Dale	
R26, 63	Res., Film, 2K, 1/8w; 1%	Dale	
R27	Res., Film, 3.57K, 1/8w; 1%	Dale	
R28	Res., Film, 6.34K, 1/8w; 1%	Dale	
R29	Res., Film, 11.3K, 1/8w; 1%	Dale	
R30	Res., Film, 20K, 1/8w; 1%	Dale	
R32,73,74	Res., Film, 1M, 1/8w; 1%	Dale	
R34	Res., Film, 49.9K, 1/8w; 1%	Dale	
R36, 41,72	Res., Film, 100Ω 1/8w; 1%	Dale	
R37,47,48	Res., Film, 100K, 1/8w; 1%	Dale	
R38,52	Res., Film, 1.05K, 1/8w; 1%	Dale	
R40	Res., Film, 3.16K, 1/8w; 1%	Dale	
R42	Res., Film, 2.61K, 1/8w; 1%	Dale	
R43	Res., Film, 8.25K, 1/8w; 1%	Dale	
R44	Res., Film, 26.1K, 1/8w; 1%	Dale	
R49	Res., Film, 100K, 1/8w; 1%	Dale	
R50,59,61	Res., Film, 10K, 1/8w; 1%	Dale	
R51,53,88	Res., Film, 100K, 1/8w; 1%	Dale	
R54,55,56	Res., Comp., 2M, 1/8w; 5%	A-B	
R57	Res., Comp., 2M, 1/8w; 5%	A-B	
R58	Res., Comp., 2K, 1/8w; 5%	A-B	
R60,62,64	Res., Var., 20K	Bourns	3006P-1-203
R65, 67	Res., Film, 10K, 1/8w; 1%	Dale	
R66,68,69	Res., Var., 20K	Bourns	3006P-1-203
R70, 71	Res., Film, 1 M, 1/8w; 1%	Dale	
R75,	Res. Film, 499K, 1/8w; 1%	Dale	
R76, 77	Res., Film, 1 M, 1/8w; 1%	Dale	

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG. PART #
R78, 80	Res., Film, 499K, 1/8w; 1%	Dale	
R81, 82	Res., Film, 1 M, 1/8w; 1%	Dale	
R83, 86	Res., Film, 499K, 1/8w; 1%	Dale	
R84, 85	Res., Film, 1 M, 1/8w; 1%	Dale	
R87, 99	Res., Comp., 6.2K, 1/8w, 5%	A-B	
R89, 93	Res., Comp., 3 K, 1/8w, 5%	A-B	
R90	Res., Comp,, 100K, 1/8w; 5%	A-B	
R91	Res., Comp., 15K, 1/8w; 5%	A-B	
R92, 100	Res., Comp., 10K, 1/8w; 5%	A-B	
R94, 101	Res., Comp., 3K, 1/8w; 5%	A-B	
R95	Res., Comp., 2.4K, 1/8w; 5%	A-B	
R96, 97	Res., Comp., 1.5K, 1/8w; 5%	A-B	
R98	Res., Comp., 1K, 1/8w; 5%	A-B	
R102, 103	Res., Comp., 47Ω 1/8w, 5%	A-B	
Rx	Res., Film, 221K, 1/8w; 1%	Dale	
S1, 4, 5	Switch, SPDT	JBT	MPC-123
S2, 3	Switch, Rotary, 1-Pole, 10-Pos.	ALCO	MRA-1-10S
	MISCELLANEOUS		
	Testpoint,Red	AMP	3-582118-2
	Testpoint, Orange	AMP	3-582118-3
	Testpoint, Yellow	AMP	3-582-118-4

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG.PART #
C29, 30	Cap.,Elect.,640 uF; 25V	Bruel & Kjaer	CE-0419
D18	Diode, Bridge Rectifier	Motorola	MDA-942A-2
D19	Diode, Zener; 12V, 5W	Motorola or Cent.	IN 5349A
D20, 21	Diode, Silicon	Motorola	IN 4002
IV	Inverter, 12V to ±15V	StevensArnold	A12/D15/150Z
IC	Regulator, 5V	Fairchild	UGH-7805393
R106	Resistor, 2 Ohm, 2-1/4 w.	Ohmite	995-2A-3867
R107	Resistor, 10K; 1/4 w; 10%	AB	
T 1	Transformer	Triad	F-105Z

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG. PART #
C37	Cap., Ceramic, .001 uF @ 500 V	Erie	315-005-X5R0-102K
C38,39,40	Cap., Elect., 10 uF @ 35 V	Mallory	MTA-10D35
C41,42,43	Cap., Elect., 10 uF @ 35 V	Mallory	MTA-10D35
C44,45,46	Cap., Elect., 10 uF @ 35 V	Mallory	MTA-10D35
C47,48,49	Cap., Elect., 10 uF @ 35 V	Mallory	MTA-10D35
C50	Cap., Elect., 10 uF @ 35 V	Mallory	MTA-10D35
C51	Cap., Tant., Elec., 1.5 uF @ 35 V	I T T	TAG-20-1.5/35-20
D30,31,32	Diode, Silicon	G. E.	IN-4148
D33,34,35	Diode, Silicon	G.E.	IN-4148
D36,37,38	Diode, Silicon	G. E.	IN-4148
D39	Diode, Silicon	G. E.	IN-4148
IC 8, 9	Hex, non-inverting Buffer	T. I.	SN 7407N
I 6, 7	1 of 16 Decoder/Multiplexer	T. I.	SN 74154N
IC 4	Divide by Twelve Counter	Motorola	MC 7492P
IC 5	Monostable Multivibrator	T. I.	SN 74121N
IC 10,11,12	Decade Counter	T. I.	SN 74L90N
IC 13,14,15	Decade Counter	T. I.	SN 74L90N
IC 16,17,18	Decade Counter	T. I.	SN 74L90N
IC 19,20,21	Decade Counter	T. I.	SN 74L90N
IC 22	Decade Counter	T.I.	SN 74L90N
J2	Connector		
	In-Contact Polarization Key for Connector J3	Cinch-Jones	50-PK-1
J3	Connector, edge	Cinch-Jones	50-6B-10
J6	Connector	Amphenol	17-10150
P4	Connector		
P5	Connector, 14-pin	Cinch-Jones	57-10140
Q11,12,13	Transistor, Silicon, PNP	T. I.	2N3702
Q14,15,16	Transistor, Silicon, PNP	T. I.	2N3702
Q17,18,19	Transistor, Silicon, PNP	T. I.	2N3702
Q20,21,22	Transistor, Silicon, PNP	T. I.	2N3702
Q23	Transistor, Silicon, PNP	T. I.	2N3702
R118	Res., Film, 10K, 1/8w, 1%	Dale	
R119	Res., Film, 1K, 1/8w, 1%	Dale	
R120	Res., Var., 100K	Mallory	MTC15L4
R121, 122	Res., Comp., 20K, 1/8w, 5%	A - B	
R123, 124	Res., Comp., 20K, 1/8w, 5%	A - B	
R125, 126	Res., Comp., 20K, 1/8w, 5%	A - B	
R127, 128	Res., Comp., 20K, 1/8w, 5%	A - B	
R129, 130	Res., Comp., 20K, 1/8w, 5%	A - B	
R131, 132	Res., Comp., 20K, 1/8w, 5%	A - B	
R133	Res., Comp., 20K, 1/8w, 5%	A - B	

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG. PART #
R134, 135	Res., Comp., 100 Ω 1/8w, 5%	A - B	
R136, 137	Res., Comp., 100 Ω 1/8 w, 5%	A - B	
R138, 139	Res., Comp., 100 Ω 1/8w, 5%	A - B	
R140, 141	Res., Comp., 100 Ω 1/8w, 5%	A - B	
R142, 143	Res., Comp., 100 Ω 1/8w, 5%	A - B	
R144, 145	Res., Comp., 100 Ω 1/8w, 5%	A - B	
R146	Res., Comp., 100 Ω 1/8w, 5%	A - B	
R147, 148	Res., Comp., 10K 1/8w, 5%	A - B	
R149, 150	Res., Comp., 10K, 1/8w, 5%	A - B	
R151, 152	Res., Comp., 10K, 1/8w, 5%	A - B	
R153, 154	Res., Comp., 10K, 1/8w, 5%	A - B	
R155, 156	Res., Comp., 10K, 1/8w, 5%	A - B	
R157, 158	Res., Comp., 10K, 1/8w, 5%	A - B	
R159	Res., Comp., 10K, 1/8w, 5%	A - B	
R160, 161	Res., Comp., 4.7K, 1/8w, 5%	A - B	
R162, 163	Res., Comp., 4.7K, 1/8w, 5%	A - B	
R164, 165	Res., Comp., 4.7K, 1/8w, 5%	A - B	
R166, 167	Res., Comp., 4.7K, 1/8w, 5%	A - B	
R168, 169	Res., Comp., 4.7K, 1/8w, 5%	A - B	
R170, 171	Res., Comp., 4.7K, 1/8w, 5%	A - B	
R172	Res., Comp., 4.7K, 1/8w, 5%	A - B	

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG. PART #
I 1	Lamp - color RED	Sloan	105S-R-Q-F59
M 1	Meter	Internat'l	M 1122
	Miscellaneous		
	Knob, 1/8-inch Metal Bushing	Rogan	RB-67-0-M-L-L

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG. PART #
C 35	Cap., Mica, 68 pF, 500 V, 5%	C D E	CD10ED680J
D 29	Diode, Silicon	G. E.	IN 4148
IC 23	MOS Counter, Time-Base	Mostek	MK5009P
R 115	Res., Comp., 18M, 1/8w, 5%	A - B	
R 116	Res., Comp., 12M, 1/8w, 5%	A - B	
R 117	Res., Film, 24.9K, 1/8w, 1%	Dale	
	Miscellaneous		
	Crystal, 100 KHz	Internat'l Crystal	

SYMBOL	DESCRIPTION	TYP. MFGR.	MFG. PART #
F 1	Fuse, 1/2 Amp.	Littlefuse	312.500
J 5	Connector	Cinch-Jones	57-20140
J 7	Connector, Socket	Bruel & Kjaer	JJ-0127
NE 1	Neon Lamp, RED (tineon)	Leecraft	36N-2311
P 1	Connector, 4-pin	Winchester	JF4P-BCD
P 6	Connector	Amphenol	17-90150-15
P 7	Connector	B & K	
K 1,2,3	Counter, Impulse	Kessler-Ellis	ER-404-01
K 4,5,6	Counter, Impulse	Kessler-Ellis	ER-404-01
K 7,8,9	Counter, Impulse	Kessler-Ellis	ER-404-01
K 10,11	Counter, Impulse	Kessler-Ellis	ER-404-01
K 12, 13	Counter, Impulse	Kessler-Ellis	ER-404-01
	Miscellaneous		
	AC Line Cord	Belden	17237S
	Microphone	Bruel & Kjaer	4117
	60 dB Overlay	Lloyd	B&K A-1670-1
	65 dB Overlay	Lloyd	A-1671-1
	70 dB Overlay	Lloyd	A-1672-1
	75 dB Overlay	Lloyd	A-1673-1
	80 dB Overlay	Lloyd	A-1674-1
	85 dB Overlay	Lloyd	A-1675-1
	90 dB Overlay	Lloyd	A-1676-1
	95 dB Overlay	Lloyd	A-1677-1
	100 dB Overlay	Lloyd	A-1678-1

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
14A	ECO 14-699	4-79	[illegible]

20K 11.3K 6.34K 3.57K 2K 1.13K 634 357

R22 357

R21 95.3

60dB

S2

S45

C52 33pf

S35 68.1K

2.9K

C WEIGHTING

C7

C17

7dB ADJ

100K

AMP

ASS'Y BL 7-0166 =
DIGITAL BD
XL 7-0166

+5V

KEY

C37 .001

R118 10K

IC5

INPUT DECODER MULTIPLEXER IC16

12TH COUNTER GREATER THAN (>)

030

I.22 COUNTER

TYP

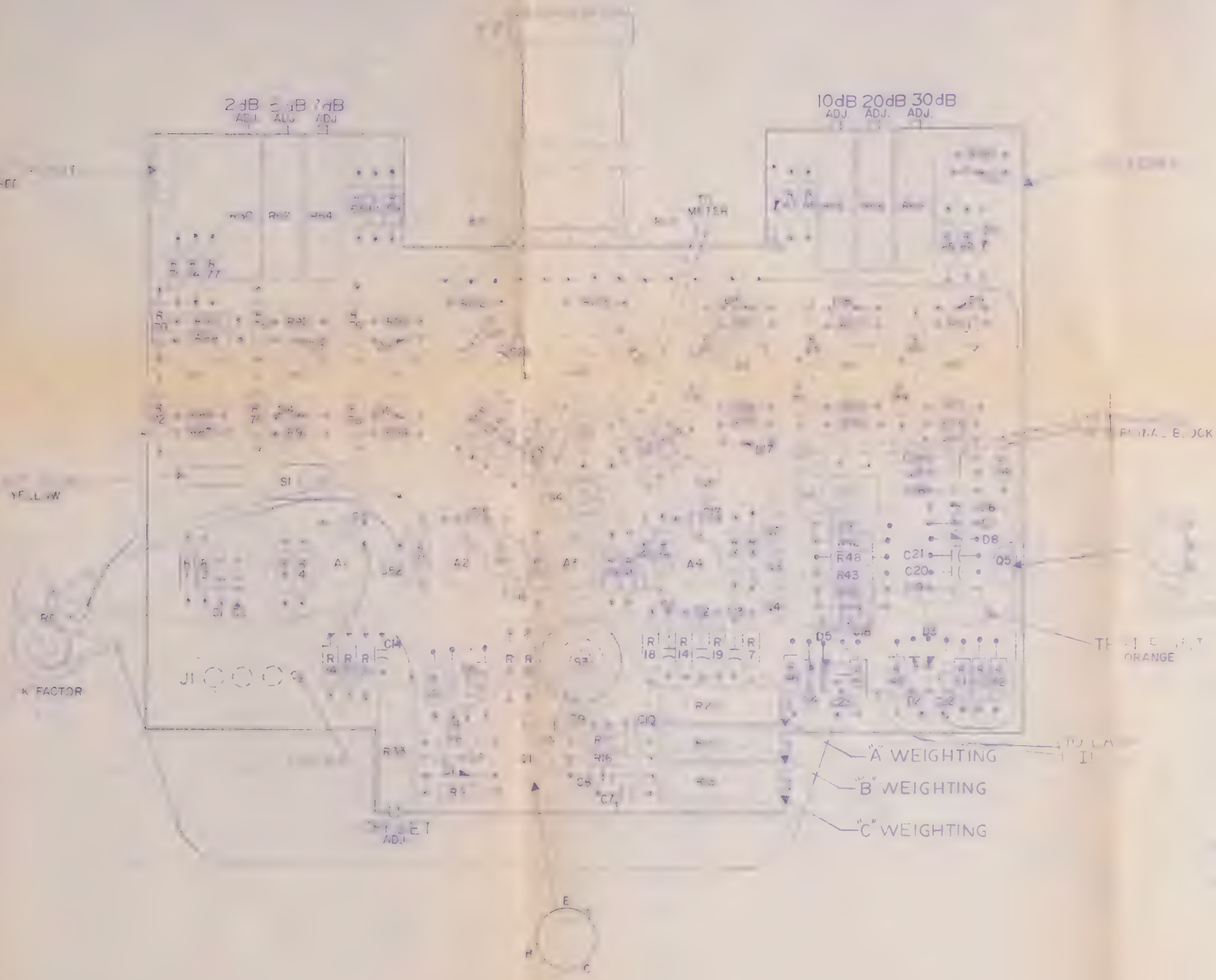
F2

BL G Y O R

B & K INSTRUMENTS, INC.
CLEVELAND, OHIO 44102

SIZE D

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

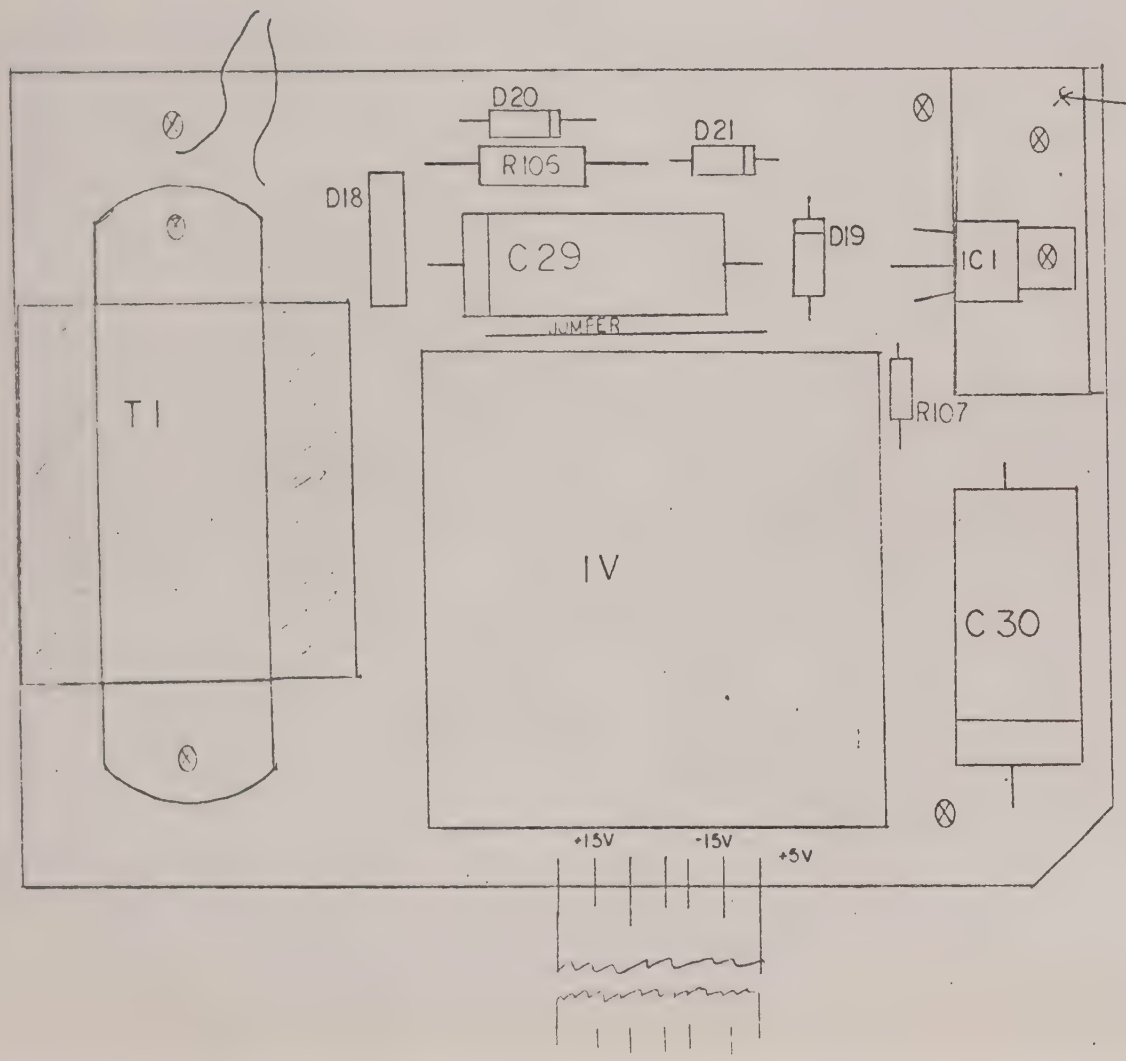


VALID FROM S/N 101

SCALE 2X	NEXT ASS'Y	S.O.
TITLE: COMPONENT LAYOUT BLI-0166 ANALOG BD		B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142
DRAWN B.Locker DATE 3-9-73	SIZE C	DRAWING NUMBER 1725
CHECKED DATE		ISSUE 1
APPROVED DATE		

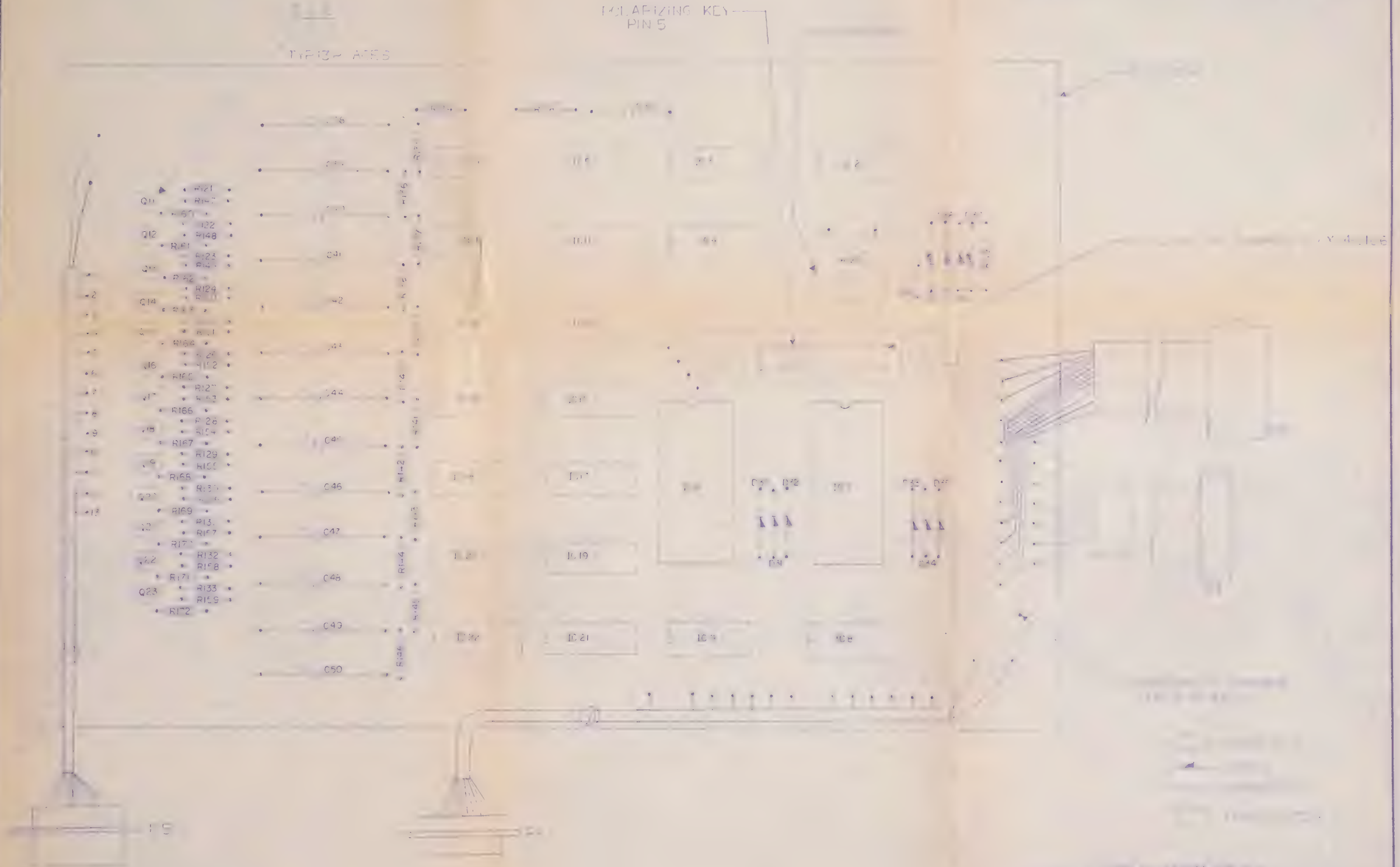
2dB ADJ.
5dB ADJ.
7dB ADJ.
TEST POINT
RED
R50
R62
R64
R63
R61
R53
R71
R74
R77
R70
R90
R88
R73
R92
D3
R76
R91
D12
R112

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
166B	Update	5/74	J.T.

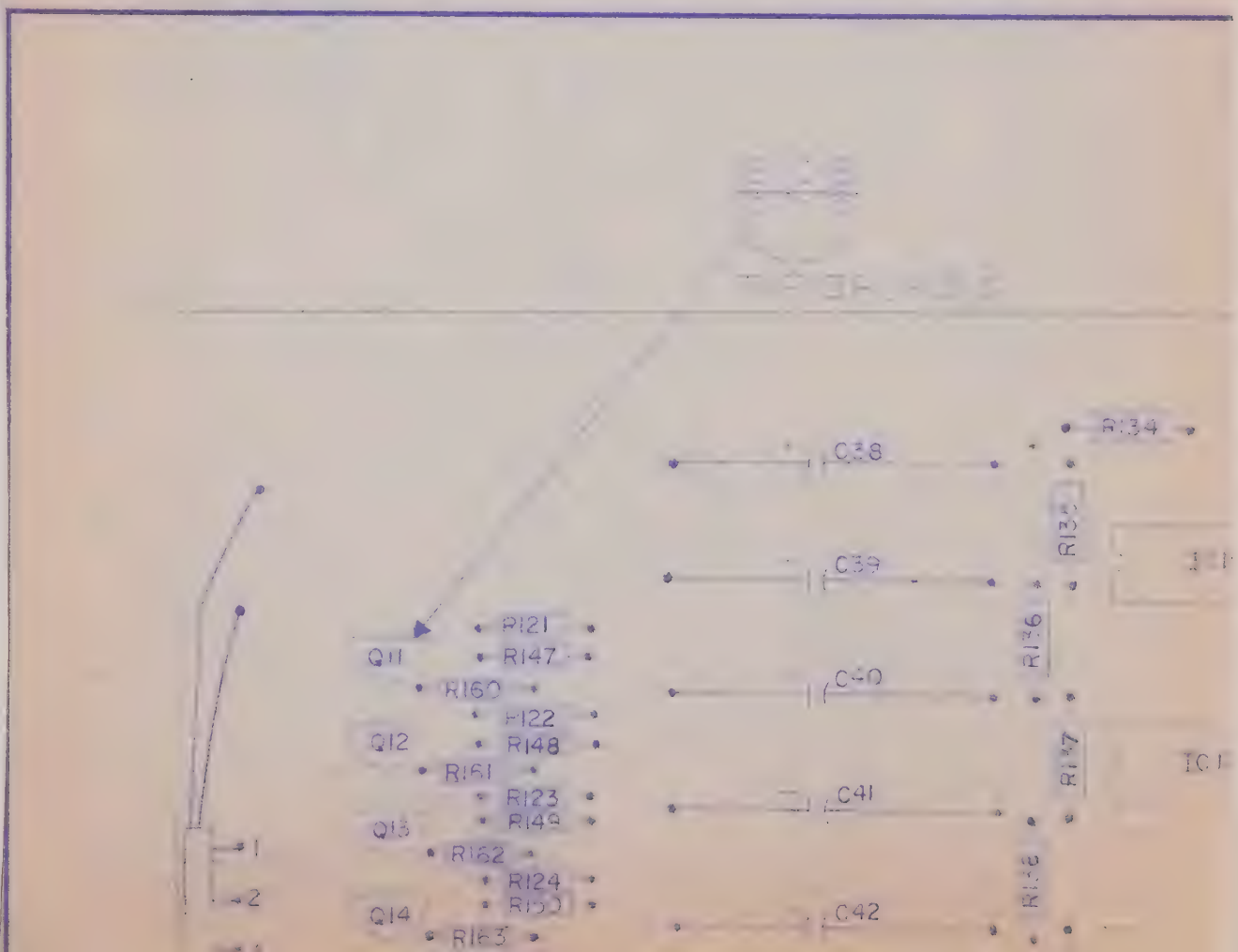


SCALE 1/2	NEXT ASS'Y	S.O.
TITLE POWER SUPPLY COMPONENT LAYOUT PL2-0166		B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142
DRAWN [illegible] DATE [illegible]	SIZE B	DRAWING NUMBER 1125
CHECKED [illegible] DATE [illegible]		ISSUE [illegible]
APPROVED DATE		

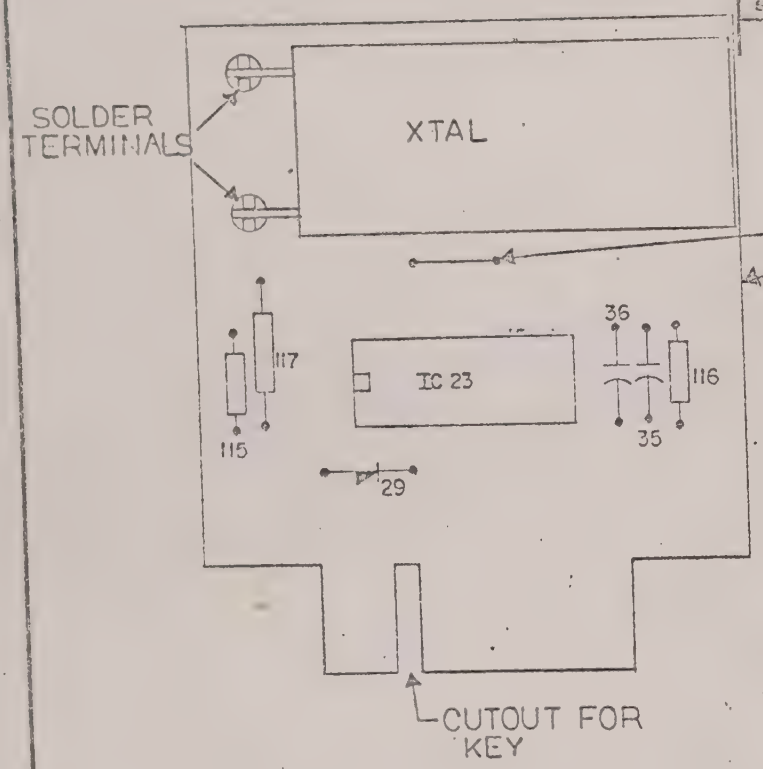
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



SCALE	NEXT ASS'Y	S.O.
TITLE: COMPONENT LAYOUT BL 3-0166 DIGITAL BD.		B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142
DRAWN DATE	SIZE: C	DRAWING NUMBER: 1727
CHECKED DATE		ISSUE: 1
APPROVED DATE		


R134
C38
C39
C40
C41
C42
R136
R137
R138
IC1
Q11
R121
R147
R160
R122
Q12
R148
R161
R123
R149
Q13
R162
R124
Q14
R163
1
2

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

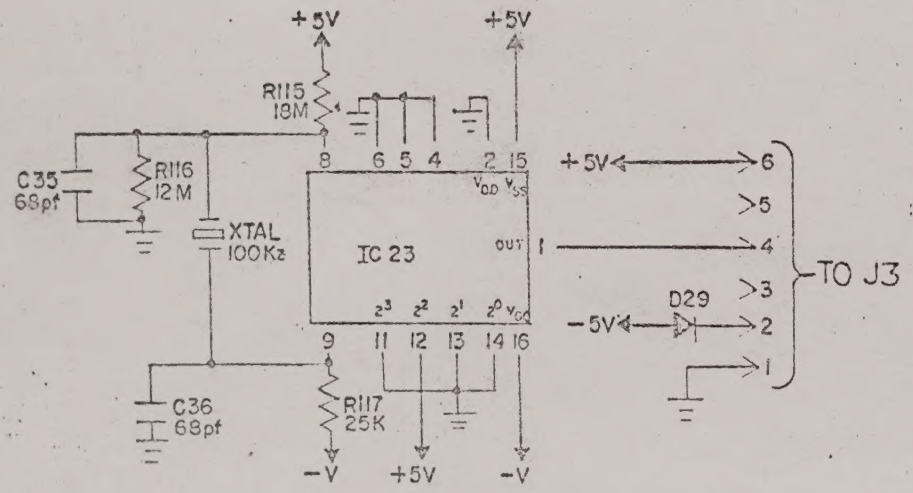


RESISTOR
CAPACITOR
DIODE

VALID FROM S/N 101

SCALE 2X	NEXT ASS'Y	S.O. 166 B
TITLE COMPONENT LAYOUT BL 6-0166 CRYSTAL OSC. BD		B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142
DRAWN D. Looker DATE 4-9-73 CHECKED DATE 4-10-73 APPROVED DATE 4-11-73	SIZE A	DRAWING NUMBER ( ) ISSUE 1

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



VALID FROM S/N 101

SCALE	NEXT ASS'Y	S.O.
TITLE: SCHEMATIC- CRYSTAL OSC. BD. MODEL 166B		B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142
DRAWN B. Lockie DATE 4-9-73	SIZE: A	DRAWING NUMBER: 812
CHECKED DATE		ISSUE: 1
APPROVED DATE		